User Manual

B-Box2.5~ B-Box10.0

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Please do not hesitate to contact us for further information.

BYD Company Limited

TEL: 0755-8988 8888

FAX: 0755-8961 9653

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SAFETY PRECAUTION

Warning, notice, and caution

Users are kindly requested to use the battery, delivered from BYD COMPANY LIMITED in strict accordance with the Datasheet and remarks included at the end of the document.

BYD COMPANY LIMITED will not guarantee against any accidents occurring due to the use of the product outside the requirements mentioned in this Datasheet.

WARNING

Do not crush.
Dispose according to safety regulations (Do not dispose in fire or water).
Recharge Battery at least every 6 months (incl. when in storage).
Once discharged, recharge battery within 48hours.
Do not expose to temperatures above 60℃（140℉）.
Must be grounded correctly. Do not put front panel face down.
Do not short, reverse polarity or connect in series.
Disconnect from power and load before maintenance.
May only be used by qualified professionals.

NOTICE

Inadvertent operation of damaged B-BOX can lead to a hazard situation that may result in serious injury due to electrical shock. The B-BOX can only be operated, when it is technically faultless and in an operationally safe state.
Regularly check the B-BOX for visible damage. Make sure that all safety equipment is freely accessible at all time. If the B-BOX is damaged, do not touch it.
Please immediately contact your after sale service if a significant event message is shown on the LCD inverter.

CAUTION

Li-ion battery inside, when disassembling the system, do not intentionally short the positive (+) and negative (-) terminals with metallic objects.
All works on system and electrical connections must be carried out by qualified personnel only.
B- Box provides an emergency switch that has to be used in case of emergency.
A potentially hazard circumstance, such as excessive heat or electrolyte mist may occur due to incorrect operation, damage, or abuse. If the safety precautions and the warning messages described are not fully understood, or if you have any questions, please contact the after sales service for guidance.

The safety section may not include all regulations for your locale. Personnel working with B-BOX must review applicable federal, state and local regulations as well as the industry standards regarding this product.
During the transport of the system with the package type, remove the battery from the cabinet, and transport both of them separately.

1 User manual information

This user manual introduces the B-BOX product information. Using the guidance and the safety caution items, any normal failure actions can be done by the user. When using the B-BOX, if any abnormal failure or urgency occurs, please contact immediately the after service center.

2 B-Box system introduction

2.1 System Brief introduction

B-Box stands for battery box, and it is the energy storage part of the electric power system in household. The box includes BYD's lithium ferrum battery, with an excellent performance. In each box, there are 1/2/3/4 pcs batteries modules. The box supports parallel connection to expand the capacity from 2.5Kwh to 80Kwh. We can meet various capacity requirements from the user´s specifications.

Figure 1 External drawing

Figure 2 Internal drawing

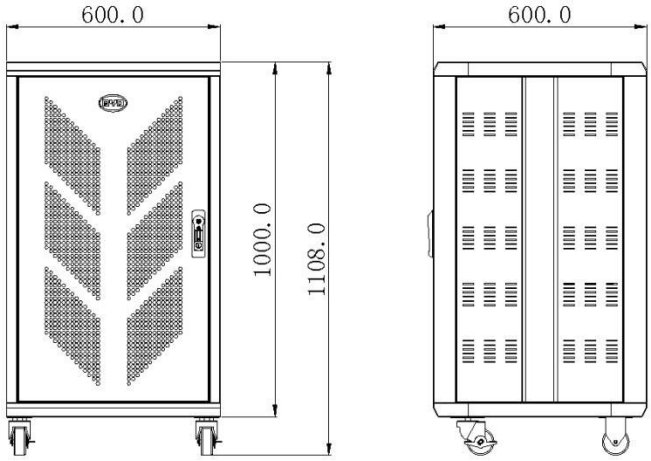

Figure 3 Structure dimension drawing

2.2 Configuration table

No.	Component	Name	Description
1	Cabinet	B-Box Cabinet	The outer Cabinet to install the B-Plus 2.5 inside and provide DC output
2	Battery	B-Plus2.5	Battery module with 51.2V44Ah, BYD's P/N is: U3A1-50P-A.
3	BMU	BMU	Provides communication with the external equipment.
4	Activate part	D48-2900	Activates the inverter and the battery.
5	Emergency switch	Emergency switch	Cuts-off the power in emergency case.

Table 1 configuration list

2.3 B-BOX&B-Plus definition

The BYD battery box series products- B-Box5.0~B-Box10.0 are defined as below:

- B-Box: Battery-Box (Cabinet)
- B-Plus2.5: battery unit with nominal capacity: 2.5Kwh. It will be installed inside the cabinet as an energy storage module
- B-Box2.5: Battery nominal capacity: 2.5 Kwh(Cabinet with 1pcs B-Plus2.5)
- B-Box 5.0: Battery nominal capacity: 5.0 Kwh(Cabinet with 2pcs of B-Plus2.5 which are connected in parallel)
- B-Box 7.5: Battery nominal capacity: 7.5 Kwh(Cabinet with 3pcs of B-Plus2.5 which are connected in parallel)
- B-Box 10.0: Battery nominal capacity: 10.0 Kwh(Cabinet with 4pcs of B-Plus2.5 which are connected in parallel)

2.4 System diagram

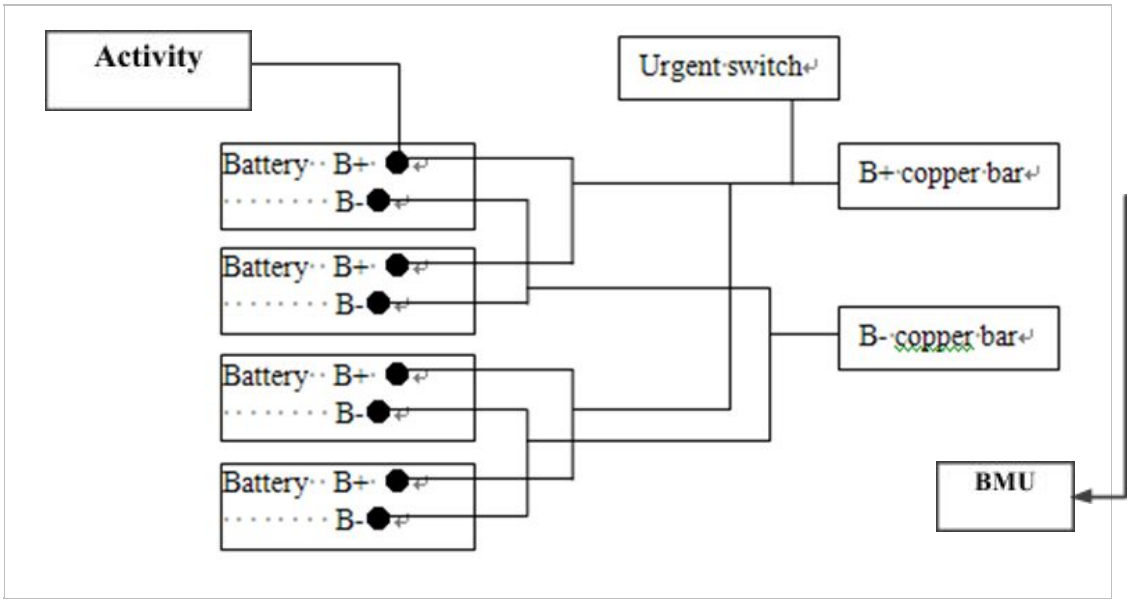

Figure 4 System diagram

2.5 System parameters

	B-Box 2.5	B-Box 5.0	B-Box 7.5	B-Box 10.0
Battery Type	Lithium Iron phosphate battery			
Battery module type	B-plus2.5			
Rated battery energy (0.2C charge &discharge at @+25℃)	2.5 Kwh	5 Kwh	7.5 Kwh	10 Kwh
Output power	Max 2.5 Kw	Max 5Kw	Max 7.5Kw	Max 10 Kw
Usable battery energy	2.4Kwh	4.8Kwh	7.2Kwh	9.6kwh
Nominal voltage	51.2V			
Energy efficiency	>97%			
Working voltage range	44.8V-57.6V			
Communication	RS485/CAN			
Cabinet Net Dimension	Width 600* depth 600* mm height 1108			
Net Weight	88 Kg	126Kg	164Kg	202Kg
IP level	IP20			

Table2 system parameters

3 General introduction of B-Plus 2.5

3.1 B-Plus 2.5 brief introduction

B-Plus is the commercial name of BYD U3A1-50P-A backup battery with 51.2V& 50Ah which is designed for energy storage application.

Figure 5 B-Plus 2.5 overview

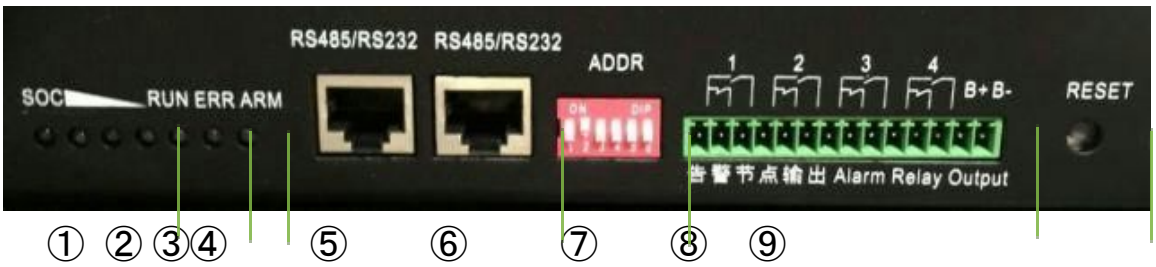

Figure 6 Display and communication interface

Table 3 Display and communication interface

No.	Interface	Mark	Function
①	SOC LED	SOC	Indicates the State of charge of the battery
②	RUN LED	RUN	Indicates the positive is in running status
③	ERR LED	ERR	Indicates error status

④	Alarm LED	ARM	Indicates alarm status
⑤	RJ45 terminal	RS232/RS485	Communication ports
⑥	Address	ADDR	In case of parallel connection, it needs to be set up address.
⑦	FPC	]	Dry contact application, output alarm info.
⑧	Test terminal	B- B+	It measures the battery voltage during testing.
⑨	Reset	RESET	Activate battery when no external power added battery.

U3A1-50P-A production includes batteries & BMS (battery management system), and external shells, as it can be seen in the following figure.

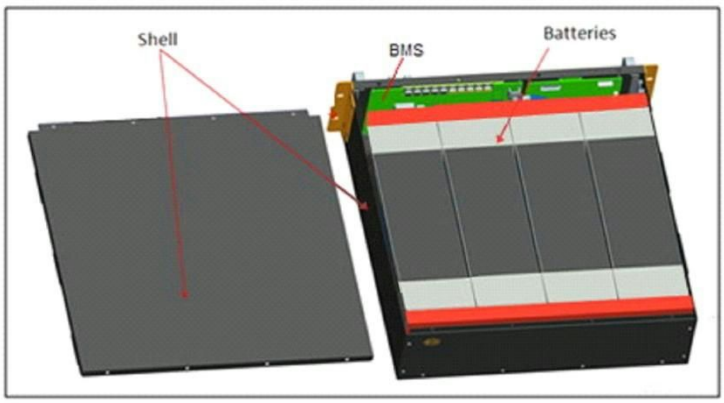

Figure 7 Internal Structure diagram

3.2 Technical parameters

3.2.1 Charge & Discharge performance parameters

Table 4 Charging parameters

No.	Item	Requirement			Unit	Remark
		Min.	Max.	Typical		

1	Charge voltage (equalized charge) chargecharge)		58.5 (protect level)	56.5	V(DC)	
	Charge voltage (floating charge)	54.4		55.2	V(DC)	
2	Charge current	0	50	25	A	-10℃~0℃ recommend charge current is 4A 0℃~10℃ recommend charge current is 8A. 10℃~70℃ recommend charge current is 25A.

Table 5 Discharging parameters

No.	Item	Requirement			Unit	Remark
		Min.	Max.	Typical		
1	Discharge voltage	40		51.2	V(DC)	
2	Discharge current		60	25	A	
3	Backup power		2560		Wh	

3.2.2 Operating environment

Table 6 Operating environment parameters

No.	Item	Requirement			Unit	Remark
		Min.	Typical	Max.		
1	Discharging temperature	-20	25	60	℃	
2	Charging temperature	-10	25	60	℃	
3	Relative humidity	5		95	%	
4	Absolute humidity	0.26		25	g/m^3	

5	Elevation	-	2000	-	m	
6	Cooling	Do not need peripheral cooling equipment				
7	IP level	20				
8	Storage and Temperature(shutdown mode)	When the storage temperature is 25℃, should charge-discharge battery at least one cycle every 12 months or charge batteries according to the “NEXT CHARGE” label in package.				
		When the storage temperature is 35℃, should charge-discharge battery at least one cycle every 6 months.				
		When the storage temperature is 45℃, should charge-discharge battery at least one cycle every 3 months.				
9	Normal Maintenance(shutdown mode)	Stored at room temperature, should charge-discharge battery at least one cycle every 12 months.				
10	Low voltage maintenance	The battery will exit the system automatically due to low voltage protection.If the temperature is 25ºC need to be charged within 30days.				
		The battery will exit the system automatically due to low voltage protection.If the temperature is 45ºC need to be charged within 7days.				

4 BMS FUNCTION DESCRIPTION

4.1 BMS introduction

The BMS is an important component that has effect on both, battery protection and monitor. In the long-term process of using batteries, the consistence difference of battery pack, may causes voltage difference and SOC difference from the cell. The cell holding higher SOC may be easily fully charged and cell keeping lower SOC may cause over discharge and lead to cell failure.

Over charge/discharge will cause a series of problems, such as, increase of resistance, lithium ion separation, power degradation etc. As well as decrease of the efficiency of charge/discharge, shorten the cycle life and cause potential risk. So, the BMS avoids over charge/discharge of the battery pack or cell unit in order to use batteries in the best way.

4.2 BMS technical terms

Table 7 BMS technical terms

No.	Terms	comment
1	Discharge	The battery returns power to the load or other equipment
2	Charge	The battery gets the power from power supply(such as DC charger)
3	Full charged	The battery has been fully charged, SOC is 100%.
4	Idle	The battery is not on charge status nor discharge, and has not been fully charged.
5	Shutdown mode	Power off.
6	SOC	Status of the charge.
7	SW	Software.
8	HW	Hardware.
9	Battery voltage	The voltage between B+/B-.
10	Pack voltage	The voltage between P+/P-.
11	Cell voltage	Single cell voltage.
12	Failure	The battery or BMS are broken, need to change to a new unit.
13	Alarm	The battery will stop charging or discharging immediately.
14	Protect	The battery stops charging or discharging (e.g. cell is under voltage), and it is resumed.

4.3 Protection Function and warning function

The protection function works as described below:

Table 8 protection function list

No.	Function

1	PACK overvoltage protection
2	Battery overvoltage protection
3	Battery under voltage protection
4	Cell over charge protection
5	Cell over discharge protection
6	Over current Protection of charging
7	Over current Protection of discharging
8	Short circuit protection
9	Reverse connect protection
10	High temperature Protection
11	Low temperature Protection
12	LED Display
13	Communication Function
14	Equalization Function
15	Capacity Calculation

Remarks:

The BMS will turn off in the following conditions:

- ✓ Cell over discharge protection
- ✓ Battery under voltage protection
- ✓ Discharge over current protection

4.4 Alarm items

Table 9 Alarm list

No.	Type	Warning items

1	Battery	Cell overvoltage
2		Cell low-voltage
3		Battery over voltage
4		Battery low-voltage
5		Cell high temperature
6		Cell low temperature
7		Cell failure
8	BMS	Charge overcurrent
9		Discharge over current
10		Short circuit
11		Reverse connection
12		Major loop failure (reserve)
13		Voltage sampling failure
14		Temperature Sampling failure
15		Current Sampling failure (reserve)

4.5 Battery status (LED display)

The LEDs on the panel displays different cases depending on the status of the batteries, please see table 10.

Table 10 LED display explaining

No.	Work indication	Warning indication	ERROR indication	Indication
	RUN	ALARM	ERROR	
1	OFF	OFF	OFF	The battery module is in unactivated state(Shutdown)
2	Slow flash			Battery module is on charging status and doesn't have any warning.
3	Fast Flash			Battery module is on discharging status and doesn't have any warning
4	On			Battery module is fully charged or on idle status and doesn't have any warning.
5	OFF	ON		Battery module is on protection status.
6	OFF	Slow flash		Battery module is trying to power down
7	ON	ON		Battery module needs to be calibrated
8	OFF	OFF	ON	Battery module is on failure status

Remark:

Sparkle: Indicator light is on and off every 1s (0.5Hz).

Flash: indicator light is on and off every 0.25s (2HZ)

Capacity LED indicator light (the current capacity light) only sparkles with 0.5HZ when it's being charged, and other condition is normally on.

Table 11 SOC status and indicate

Item	Status	Indicate
1	Four lights are all normally on	Capacity is 100%-75%
2	The last three lights are normally on	Capacity is 74%-50%
3	The last two lights are normally on	Capacity is 49%-25%

4	The last one light is normally on	Capacity is 24%-0%

4.6 Alarm information and solution

If a failure occurs, such as over-voltage protect or over-current protect, the user can solve the problem using the suggestion shown on Table 12:

Table 12 Alarm information and solution

Status	Alarm info.	LED display
Charging	Pack over-voltage	ALM LED on
	Over-current	ALM LED on
	Over-temp.	ALM LED on
Discharging	Over-current	ALM LED on
	Over-temp.	ALM LED on
	Batteries over-discharge	ALM LED on
	Cell over-discharge	ALM LED on

Remark: When under voltage warning happens on the battery or cell, ALM LED will be on, and the battery will exit the system 1 minute later.
If the alarm continues, please contact with the after sales service staff.

5 POWER ON

When the installation has been finished (please refer to the installation guidance), the operator should check the cable connections in detail, and make sure that all the cables have been properly placed. Afterwards, the operator can power the system.

Remark: The operator has to make sure that the emergency switch is not on “PUSH INTO” status.

Grid activity:

The system will run automatically when external power input is applied.

Handle activity:

Press the “RESET” on the front panel, then the system will be running.

Once that the system is activated the LED lights will be in different status according to the battery status, as it is shown below:

Table 13 Alarm information and solution

Item	Status	Indicate
1	Charging	Green light is blinking, Red light is OFF
2	Charge protection	Green light is ON, Red light is blinking
3	Fully charged	Green light is ON, Red light is OFF. ALL SOC lights are ON
4	Failure mode	Green light is OFF, Red light is ON. ALL SOC lights are OFF

6 EXIT SYSTEM

When the user wants to stop the system he can press the “Reset” button on the front panel. Then, the battery can be safely taken out of the system. Another way is to press the emergency switch, then the B-Box will be cut off from the external equipment.

7 MALFUNCTION DIAGNOSE

Table 14 Normal failure and action

No.	Failure item	Action
1	Malfunction alarm	When the “Alarm” LED is lighting continuously, please contact the after service personal.
2	Communication failure	If there is a failure on RS485/CAN communication, it could be solved as below. Check the communication cables; if the alarm does not disappear, please contact the after service personal.
3	Failure protection	Please contact the after service personal.
4	Over current protection	It is a normal case during charge, when over current protection occurs, the yellow LED will lighting until the protection releases. This function will release automatically.
5	Other failure	Please contact the after service personal.

8 DISPOSE SPECIAL SITUATION

8.1 Black out

If a Black out happens, the battery will provide backup energy to the loads when is a short time black out. If the power off time lasts long, user should pay attention to the backup time of the battery.

8.2 Catastrophic accidents

Catastrophic accidents, including lightning, floods, earthquakes, fires and other disasters, can bring unpredictable damage to the communications equipment. To prevent these serious effects on the security of communication, the telecom stations should have emergency regulations, and procedures of major accident repair.

Contact us:

China
BYD LITHIUM BATTERY Co.,LTD
Customer Service Mailbox: eubatterygrp@byd.com
Telephone:+86 0755 89888888
Address: No.1,Baoping Road,Baolong Industrial Town Longgang Shenzhen, 518116, P.R.China

Germany
Company name :EFT Energy for tomorrow
Customer Service Mailbox: kontakt@eft-systems.de
Telephone : +49-6996759811
Address : Buchenstraße, 37 Lohr a. Main 97816 Germany.